



ODONTOLOGIC STUDIES
OF
MIDDLE-AGED URBAN WOMEN

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Malmö 1987



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URBAN WOMEN**

by

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CONTENTS

PREFACE.....	4
INTRODUCTION.....	5
AIMS OF THE STUDY.....	6
MATERIAL.....	7
METHODS.....	9
STATISTICAL ANALYSIS.....	11
RESULTS.....	12
GENERAL DISCUSSION.....	25
CONCLUSION.....	32
ACKNOWLEDGEMENTS.....	34
REFERENCES.....	35

PREFACE

This thesis is based on the following papers, which in the text will be referred to by their Roman numerals:

- I Ahlqwist M, Halling A & Hollender L. Rotational panoramic radiography in epidemiological studies of dental health.
Comparison between panoramic radiographs and intraoral full mouth surveys. *Swed Dent J* 1986. 10. 79-84.
- II Halling A & Bengtsson C. Dental status of Swedish middle-aged women as found in a population study in Göteborg, Sweden. *Swed Dent J* 1981.5.1-7.
- III Halling A & Bengtsson C. Number of teeth and proximal periodontal bone height in relation to social factors. *Swed Dent J* 1984. 8. 183-191.
- IV Halling A & Björn A-L. Periodontal status in relation to age of dentate middle-aged women. A 12 year longitudinal and a cross-sectional study. *Swed Dent J* 1986 (accepted).
- V Halling A & Björn A-L. Periodontal status in relation to education and dental attendance. A 12 year longitudinal and a cross-sectional study of a random sample of dentate middle-aged women.
Swed Dent J 1986 (accepted).
- VI Björn A-L & Halling A. Periodontal bone height in relation to number and type of teeth in dentate middle-aged women.
A methodological study. *Swed Dent J* 1986 (sent for publ).
- VII Hällström T & Halling A. Prevalence of dentistry phobia and its relation to missing teeth, alveolar bone loss and dental care habits in an urban community sample. *Acta psychiatr scand* 1984.70.438-446.

INTRODUCTION

The Swedish Parliament has put a relatively high priority to dental care, which consequently has changed markedly during the 1960-70's in many respects:

- the realization of programmed dental care for all Swedish children from birth to age nineteen in Public Health Dental Service.
- from a treatment based on a "drilling and filling"-ideology with a main interest in the treatment of caries towards greater emphasis on prevention of caries as well as periodontal disease, i.e. from a disease-oriented to a health-oriented perspective.
- a dramatic input of resources in dental manpower, clinics and equipment.
- introduction of new categories of personnel specially trained to carry out preventive programs, viz. dental hygienists and dental prophylaxis assistants.
- an increased specialization of care.
- introduction of a new insurance system for adults in 1974.
- intensified information by radio, press, TV and schools, institutions etc on dental health and prevention of dental and periodontal disease.

The insurance system had the purpose to create opportunities for every citizen to obtain good dental care at a reasonable cost.

The consequences of this can be summarized in the following way:

- elevated interest among the citizens in dental well-being.
- reduction of cariological and periodontal problems in almost all age groups
- decreasing number of edentulous individuals
- surplus of dental resources.

Due to these facts and a deteriorating economic situation the authorities have become interested in knowing more about what comes out of the money that has been spent on dental care during the last decades.

Although several studies have been published (Björn 1974, Axelsson et al 1975, Lysell L 1977, Håkansson 1978, Lavstedt 1982, Österberg 1981, Laurell L et al 1982, Palmqvist 1986 and others) our knowledge of many aspects of periodontal disease is limited.

Programmed dental care for children in Public Health Dental Service has probably been of great importance for the dental well-being of the adult population.

However, there are still individuals especially in the adult population who grew up in times and places where there was a lack of school dental service.

The distribution of health and disease in a population is not solely the effect of a certain number of dentists, hygienists, etc but also to a high degree a function of demographic, social and lifestyle factors.

THE AIMS OF THE STUDY

The aim was to study, in welldefined random samples of urban women, the loss of teeth and periodontal bone support as visualized in orthopantomographs, and to elucidate the pattern of bone loss in different parts of the dentition as well as the influence of

- socio-economic factors
- education and place of growing up
- dental visits
- dentistry phobia

The collection of epidemiologic data was performed in Gothenburg which is the second largest city of Sweden (population about 445.000 inhabitants in 1968 and 430.000 in 1980 (Gothenburg City Office 1981). Further demographic data are given elsewhere (Rinder et al 1975).

MATERIAL

Randomized samples of women in five age strata 38, 46, 50, 54 and 60 years were studied in 1968 and re-examined in 1980. In 1980 a new group of 38 year old women were examined.

The samples were obtained from the registers of the Revenue Office of Gothenburg, from which women born at certain dates were chosen:

Year of birth	Day of birth				
1942	6	12			
1930	6	12	18	24	30
1922	6	12	18	24	30*
1918	6	12	18	24	30*
1914	6	12			
1908	6				

* Only women born in Jan - June were called for examinations

Some characteristics of participants and non-participants in the dental study 1968.

Place of growing up:	Particip. (n=1418)		Non-particip. (n=44*)	
	n	%	n	%
in the Gothenburg area	752	53	28	65
in Sweden outside Gothenburg	548	39	10	23
outside Sweden	118	8	5	12
in a rural area	408	29	9	21
in an urban area	1010	71	34	79

*) data from one woman missing

Participants in 1968/69 who did not take part in 1980/81

	Number	%
Died	75	5.3
Moved from the area	90	6.3
Refused	210	14.8
Not accessible	12	0.8
TOTAL	387	27.3

Distribution of the participants described in Papers I-VII:

Paper	Year	A G E G R O U P						Total
		1	2	3	4	5	7	
I	1980	12	7	9	18	11	18	75
II	1968	356	421	391	172	78		1418
III	1968	356	421	391	172	78		1418
IV*	1968/80	264	258	223	94	23	107	862+107
V*	1968/80	263	257	222	94	23		853
	Educ 1	173	160	145	63	17		558
	Educ 2	65	65	49	19	-		198
	Educ 3	25	32	28	12	-		97
VI*	1968/80							
	862-gr	264	258	223	94	23		862
	609-gr	226	181	133	54	9		603
	259-gr	38	77	90	40	14		259
VII	1968	108	298	285	84	-		775

*) Refers to dentate individuals with measurable bone heights
in 1968 and 1980

METHODS

General procedure

The dental investigation which is presented in Papers II-VII was part of a comprehensive medical study of women at the Sahlgren's Hospital in Gothenburg (Bengtsson et al 1973) where the research staff was the same throughout each examination period. The examinations were carried out in a predetermined order and according to uniform methods. The participant women who were born in the beginning of the year were called first. The examinations were finished within the lapse of one year. In these ways age differences within each age group were minimized.

Examination procedures:

- ◇ Body height and weight. Urine specimen collected.
Questionnaires on general health.
- ◇ Physical examination.
- ◇ Peak-flow spirometry.
- ◇ Orthopantomograms and colour photography. Questionnaire.
- ◇ ECG. Blood specimina collected.
- ◇ Gynaecological examination. Questionnaire.
- ◇ A 24-hour recall of participants.
- ◇ A subgroup interviewed about dietary habits ("dietary history").
- ◇ Eyesenck Personality Inventory and a phobia test form filled in.

Dental examination

The dental status was recorded by orthopantomography and colour photography. The technical work was in 1968 performed by one specially trained dental assistant and in 1980 by the personnel at the department of Oral Radiology, University of Gothenburg. All the roentgenographs were evaluated by one and the same examiner (AH).

The following variables, defined as stated below, were studied:

- | | |
|---------------------------|--|
| ◇ Missing teeth. | Teeth not visualized on the panoramic film were listed as missing; thus impacted and clinically unerupted teeth were not counted as missing. |
| ◇ Periodontal bone height | Bone heights (expressed as bone scores) were evaluated related to the total tooth length. The 5 degree scale according to Björn & Holmberg 1966 was used (Fig1). |
| ◇ Fillings | Radiolucent/opaque fillings. |
| ◇ Crowns | Teeth with radiolucent/opaque material in the whole coronal part as visualized by orthopantomographs or colour slides. |
| ◇ Intact teeth | Teeth without fillings or other restorations, no caries detectable by orthopantomograms or colour slides. |
| ◇ Endodontic therapy | Teeth with radiopaque material in whole or part of the root canal(s). |

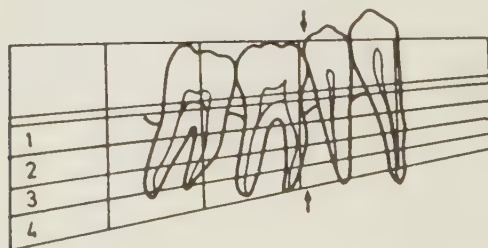


Fig.1. Ruler used for measuring boneheights. Scale fitted for image of mesial of right mandibular first molars. The bone score in this specific case is 1.

Reproducibility of readings

In 1982 the intraexaminer (AH) reproducibility of bone height measurements was tested on 50 orthopantomograms, randomly chosen from the 38 year group of the 1968 study. The reproducibility was evaluated by comparing the individual means calculated at the two occasions. Forty-four per cent of the values were slightly higher and 50 per cent were lower at the second recording. The mean difference was 0.025 and the standard error of the mean 0.020 scale divisions (Halling & Björn [IV]).

Data processing

The data treated in Papers II, III and VII were transferred to punch cards by means of an optical page reader and were then processed by an IBM 360/65 computer. Data concerning periodontal bone height were treated by means of a Macintosh microcomputer.

STATISTICAL ANALYSIS

Conventional methods were used for calculating mean values and standard deviations (SD).

The hypothesis of no differences between mean values was tested with Student's t-test and differences between mean values were tested by analysis of variance. Pitman's permutation test was used to test hypothesis of no correlation (Bradley 1968).

For analysis of frequencies, the Chi-square test was used, or, when including all age strata in the same analysis, the extension of the Chi-square procedure according to Mantel-Haenszel with one degree of freedom (Mantel 1963). In this way the effect of age as a confounding factor was diminished.

Differences were tested at the 10, 5, 1 and 0.1 per cent levels ($p < 0.05$ was considered as statistically significant).

RESULTS

PAPER I: Rotational panoramic radiography in epidemiological studies of dental health.

Comparison between panoramic radiographs and intraoral full mouth surveys.

In Papers II-VII results obtained by use of orthopantomography are described and analyzed. To study the validity of this method, the agreement between measurements on orthopantomographs and on full mouth surveys was tested. To this end radiographs of both types from 75 women belonging to the same age groups as used in the main study were randomly selected from the archives at the Department of Oral Radiology, University of Gothenburg. These radiographs were evaluated and the results compared.

Numbers of missing teeth, metallic fillings, crowns, endodontically treated teeth as well as marginal bone heights showed generally a good agreement. On the other hand caries and radiolucent restorations showed a poor agreement. Of the lesions within the dentine only 36% were diagnosed with both methods and the sensitivity value was 41%. For gross caries lesions however full agreement was obtained.

The largest differences were found for fillings in the anterior lower region of the jaw.

The frequencies of non-measurable bone heights assessed from orthopantomographs were generally significantly higher than those obtained from FMS except for lower molars and premolars, which did not show such differences. There was a very good agreement between mean score values found on FMS and orthopantomographs ($r=0.96$).

Distribution of non-measurable periodontal bone heights (bone scores) as found in orthopantomograms are depicted in Fig 2. About 80% of the mesial surfaces of upper premolars had non-measurable bone heights. Lower molars showed the lowest degree of non-measurability (0-7%). All distal surfaces of lower first molars in this sample were measurable. Non-measurability percentages for the whole dentition, the anterior regions in upper + lower jaws and posterior regions in upper+ lower jaws were 33%, 37% and 28% respectively. Lower incisors had 35-40% non-measurable surfaces. Corresponding figure for lower canines was about 20%. The distribution of

different bone score units (value 0-4 and 9=non-measurable) on mesial and distal surfaces for posterior regions in full mouth surveys and panoramic radiographs are presented in Fig 3.

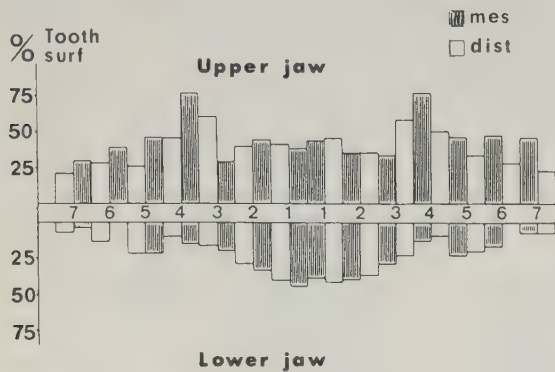


Fig.2. The distribution of non-measurable boneheights as found in orthopantomographs of 74 dentate women.

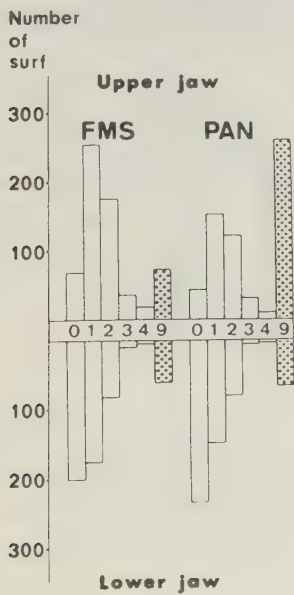


Fig.3. The distribution of differerent bone score units (value 0-4) on mesial and distal surfaces for the posterior regions in full mouth surveys and orthopantomographs.

Paper II: Dental status of Swedish middle-aged women as found in a population study in Göteborg, Sweden.

Fourteen per cent of the total 1968 sample were edentulous. Of the different age strata the 38 year old women were edentulous in 4%, the 50 year old ones in 18% and 60 year old ones in 40%.

The loss of teeth was symmetrical in both jaws (Fig 4.)

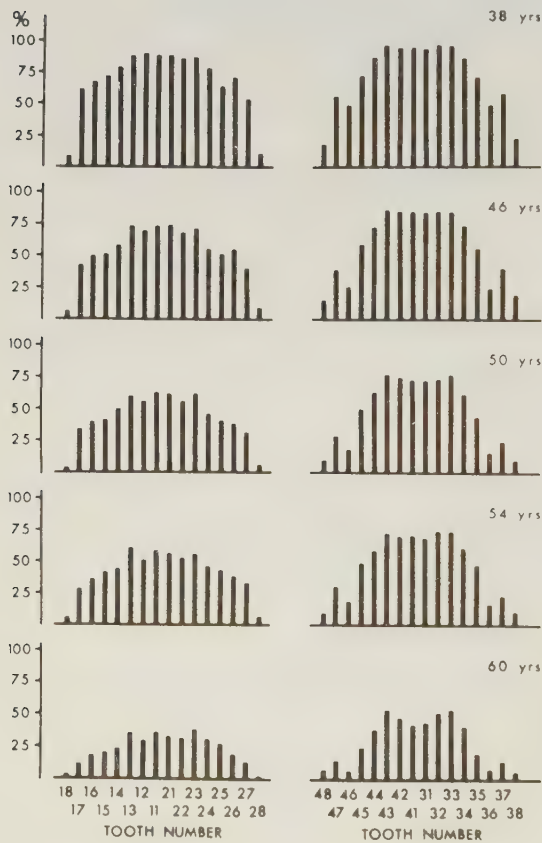


Fig.4. Percentual distribution of remaining teeth in relation to age (38-60 years) as found in 1968.

Cumulative percentages of women with on number of remaining teeth are found in Fig 5.

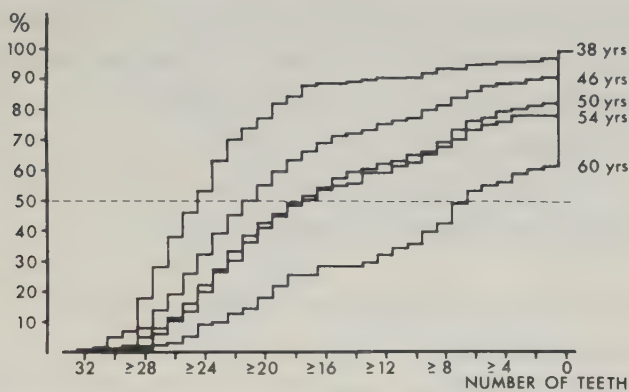


Fig.5. Cumultative percentage of women with respect to number of remaining teeth.

Mean numbers of remaining teeth in 1968 in different age groups:

	A g e g r o u p					
	38	46	50	54	60	Total
Mean	21.9	17.7	14.6	14.0	8.4	16.9
SD	7.26	8.93	9.56	9.89	9.06	9.55
n	356	421	391	172	78	1418

In the 38 year age group (1968) 10% of the participants had lost at least half the number of their teeth compared to 70% in the 60 year group. In the latter age group 10% had 24 or more remaining teeth.

Mean bone score values were 0.63,1.06 and 1.29 for 38, 50 and 60 year old participants respectively.

The percentages of intact teeth (teeth without visible fillings or radiographic carious lesions) in the total sample in relation to remaining ones ranged between 17% and 22%. Ten per cent of the optimal 32 teeth per woman were intact ranging from 15% among the 38 year group to 5% in women aged 60.

In the 38 year cohort 11% of remaining teeth had crowns. The corresponding figures in 50 and 60 year old participants were 23% and 31% respectively. Three out of four of the remaining teeth were filled in the 38 year cohort. The corresponding figure for 60 year old women was 81%. The share of endodontically treated teeth per remaining teeth varied from 14% in the 38 year old group to 21% and 28% for the 50 and 60 year old respectively.

One third of the total sample had some type of removable dentures varying from 12% in the youngest age group to 68% in the 60 year group.

Paper III: Number of teeth and proximal periodontal bone height in relation to social factors.

In the 46 year old cohort 15% of those grown up in a rural area and 8% of those grown up in an urban one were edentulous. Out of the 60 year old group the corresponding values were 57% and 31%.

In the 38 year old group with high education no woman had lost all teeth while 5.9% of the women with elementary school only were edentulous. Among the 50 year old women the corresponding figures were 6.0 and 23.4% respectively and in the 60 year old group 6.3% and 47.5%.

More than 8 teeth were on an average lost in 53% of the 38 year old women who had attended primary school and in 29% of those with high school studies. The corresponding figures in 60 year old women were 95% and 50% respectively. There was a higher number of remaining teeth in higher socio-economic groups (Fig 6).

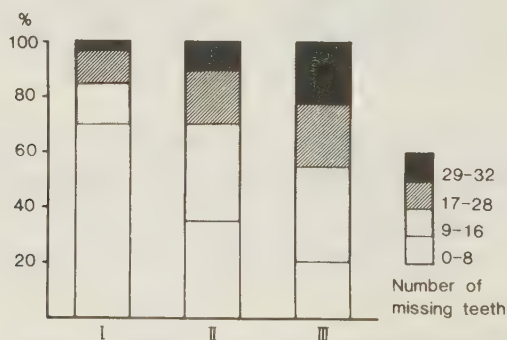


Fig.6. Number of missing teeth in relation to socio-economic group of the participating women.

No difference was found in number of remaining teeth in any age group between women who did and those who did not work outside home in each socio-economic group .

A significant difference of mean bone scores was found in the 38 year old group between women belonging to different socio-economic levels ($p < 0.05$). No difference was found in the other age groups.

PAPER IV: Periodontal status in relation to age of dentate middle-aged women in Gothenburg.

A 12 year longitudinal and a cross-sectional study.

The dentate 60 year old women in 1968 had on an average 7.0 teeth more than the 38 old ones. This difference between the age groups had increased to 8.6 in 1980. The number of teeth lost during the 12-year period varied from 1.7 in the youngest to 3.3 in the oldest group.

In the cohort study the 38 year old women had on an average 2.1 and the 50 year old ones 2.5 more remaining teeth in 1980 than the same age groups 12 years earlier. The percentage of 38 year old women with ≥ 22 remaining teeth, i.e. having at least two molars, had increased from 72.6% in the 1968 to 88.0% in the 1980 cohorts. The corresponding figures for the 50 year old women were 48.8% and 67.4%.

The distribution of individuals on mean bone scores for the individuals 38/50-60/72 years of age as found in 1968 and 1980 is shown in Fig 7.

The bone levels were lower in the older age groups at both examinations and had decreased in all age groups during the interval. This decrement was 0.21 in the youngest and 0.08 in the oldest age group. In the 1968 cohort study more than 65% of the 38 year old women had slight bone loss compared to 49% in 1980.

Corresponding figures in the 50 year cohort were 32% in 1980 and 23% in 1968.

The progression of bone loss during the 12 year interval seemed not to be related to the initial status. About 83% of the 862 participants had a mean bone level of the same magnitude at both occasions and about 5% showed a considerable loss, i.e. ≥ 0.9 score units.

In the 38 year cohort in 1980 more than 65 % of the women had only slight bone loss compared to 49 % in the same age cohort in 1968. In the 50 year old cohorts 32 % of the women in 1980 showed a slight bone loss compared to 23% in those in 1968.

1 9 8 0
(60-72 years)

1 9 6 8
(38-50 years)

	1	2	3	4	5	6	7	8	9	10	11
1	23	44	13	3	1	1		1			
2	10	84	84	23	10	2					
3	1	25	103	68	30	5	3				
4	1	3	21	61	48	23	5	1	1		
5				13	30	21	10	4			
6				3	9	25	17	7		2	2
7					1	2		5		2	1
8						1	1	1	5		
9									2		
10											
11											

BONE SCORE

1 = 0 - 0.29

2 = 0.3 - 0.59

11 = 3.0 -

Fig.7. Distribution of mean bone scores for women 38/50-60/72 years
og age as found in 1968 and 1980.

PAPER V: Periodontal status in relation to education and dental attendance.

A 12 year longitudinal and a cross-sectional study of a random sample of dentate middle-aged women in Gothenburg.

About 65% of the women in the longitudinal study had no higher education than primary school. The women at all ages in the lowest educational groups had significantly fewer remaining teeth than those in the other groups. The difference increased by increasing age from 2.9 to 6.8 teeth.

For all the participants on an average 1.7-2.0 teeth were lost in the different educational groups during the observation period.

There was no significant difference between the educational groups either in this respect or concerning the distribution of individuals on different numbers of lost teeth.

There were no differences between the groups either concerning distributions or mean bone score values. The bone scores varied independently of educational level at all ages.

The changes of bone height levels between 1968 and 1980 were grouped into 0.3 bone scores unit intervals. Pronounced progression of bone loss, i.e. ≥ 0.9 score units corresponding to approximately one fourth of the root length had occurred in 6.8, 7.5 and 4.8% of the women in respective educational group. The differences however were not statistically significant. The mean differences were about 0.2 score units in all groups.

Sixty-eight per cent of the participants in the longitudinal study had visited the dentist within the last year and 17% had paid a visit more than two years ago. There were significant differences between visit groups in number of remaining teeth at all ages except among the youngest, where this was true only between visit groups 1 and 3. The range of the differences was 3.7-7.8.

On an average 1.7, 2.3 and 2.6 teeth were lost in visit groups 1-3 during the 12-year period. The differences between visit group 1 and the two others were statistically significant. A statistical significance was found only in the youngest group between visit group 1 and 3 (1.4 and 2.9 teeth respectively, $p < 0.005$).

The distributions as well as the mean periodontal bone heights differed significantly between visit group 1 and the two others at both examinations ($p < 0.05$). The

differences of the means varied from 0.11 to 0.65 bone score units but were significant only between visit groups 1 and 3 in the two youngest age groups ($p<0.05$). In the total (862) sample the distributions of the changes of mean bone scores differed significantly between visit groups 1 and 3 ($p<0.05$). The mean difference was lowest in visit group 1, viz. 0.18 score units compared to 0.25 in the others ($p<0.05$).

In the 38 year cohorts in the cross-sectional study a significant difference between the distributions on educational level was found between 1968 and 1980 ($p<0.001$). Of those, who were 38 years old in 1980, 67% had passed more than primary school compared to only about 34% of those being 38 in 1968. There were no significant differences in the 50 year cohorts in this respect.

PAPER VI: Periodontal bone height in relation to number and type of teeth in dentate middle-aged women.

A methodological study.

The distribution of individuals according to the composition of the dentition, i.e. presence of different types of teeth, gave rise to the following subgroups:

- ◇ Individuals who had at least one tooth left of each of the different types of teeth, i.e. at least one each of molars, premolars, canines and incisors in each jaw; 603 persons, called the "603 sample".
- ◇ The remaining 259 individuals were edentulous in at least one of these regions in at least one of the jaws; the "259 sample".

The mean values of remaining teeth for the total sample and the 603 and 259 subsamples were 21.3, 24.3 and 14.2 teeth respectively.

On an average more than half of the original number of molars were lost in both jaws, while nearly all mandibular incisors and canines remained. More than 98 % of the individuals had remaining mandibular canines.

Mandibular molars and premolars showed on an average the highest measurability, 93 and 81 per cent respectively, compared to 48 and 42 per cent of the corresponding maxillary teeth. The mean bone scores in the 259 sample was 1.01 compared to 0.73 in the 603 sample ($p<0.001$). Individuals with fewer remaining teeth showed higher bone scores (more bone loss) in the 603 sample.

The distributions of the means showed a similar pattern in the two samples, with the highest bone scores at maxillary molars and the lowest at mandibular premolars and canines (Fig.8).

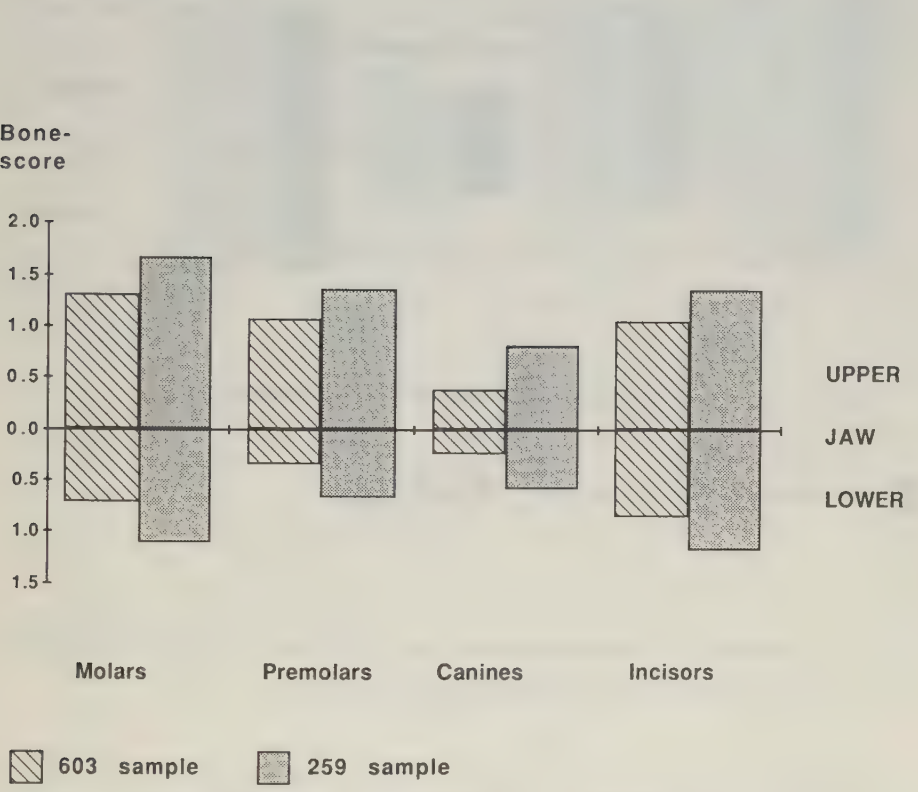


Fig.8. Distribution of mean bone score values for molars, premolars, canines and incisors in upper and lower jaw respectively.

In both samples the mean periodontal bonelevel at different types of teeth were consistently higher at all the different types of teeth in groups with the highest number of remaining teeth.
Mean scores for mandibular molars showed the best agreement with the mean for the whole dentition (Fig.9).

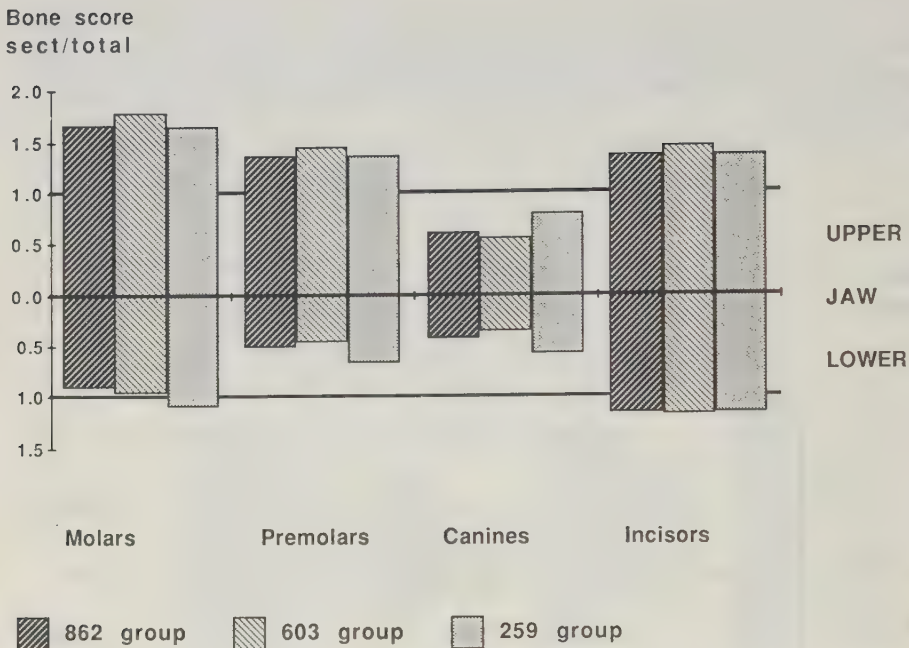


Fig.9. Distribution of the quotients between mean bone score for different types of teeth and those for the whole dentition (region/total).

In reduced dentitions the number of individuals having mandibular molars is however low. A search for other combinations of teeth or groups of teeth showed that the smallest difference was found when the means for the incisors were combined with either those for the premolars or those for the canines. Since 98 per cent of the individuals had remaining canines compared to 88 per cent having premolars, the combination of incisors + canines may indicate the region of choice to represent the whole dentition when mandibular molars are missing.

Paper VII: Prevalence of dentistry phobia and its relation to missing teeth, alveolar bone loss and dental care habits in an urban community sample.

There was a positive significant correlation between number of missing teeth (Fig.10) and mean bone heights on one side and degree of phobia on the other. The point prevalence rate of dentistry phobia was 13.4%. A high degree of dentistry phobia was observed in 4.3% and a low degree in 9.1% of the women.

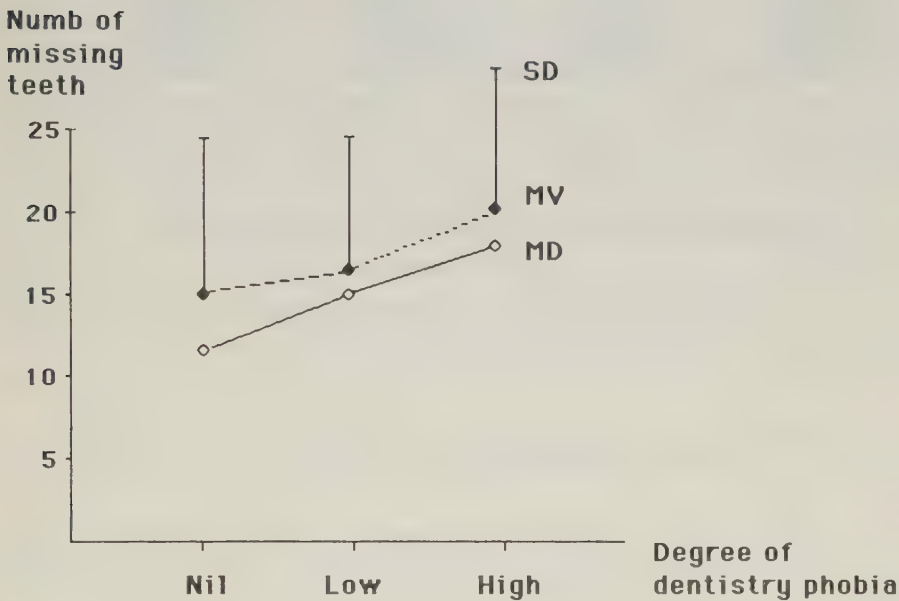


Fig.10. Number of lost teeth by degree of dentistry phobia.

MV=mean; SD=standard deviation; MD=median.

A significant difference was observed between phobia degree and amount of school education and social status.

Two thirds of the women with high degree of dental treatment phobia reported severe avoidance of visiting a dentist.

The time elapsed since the last dental treatment was significantly longer for phobic women and especially for those with high degree phobia.

The prevalence rates of dentistry phobia showed no significant age trends (Fig.11).

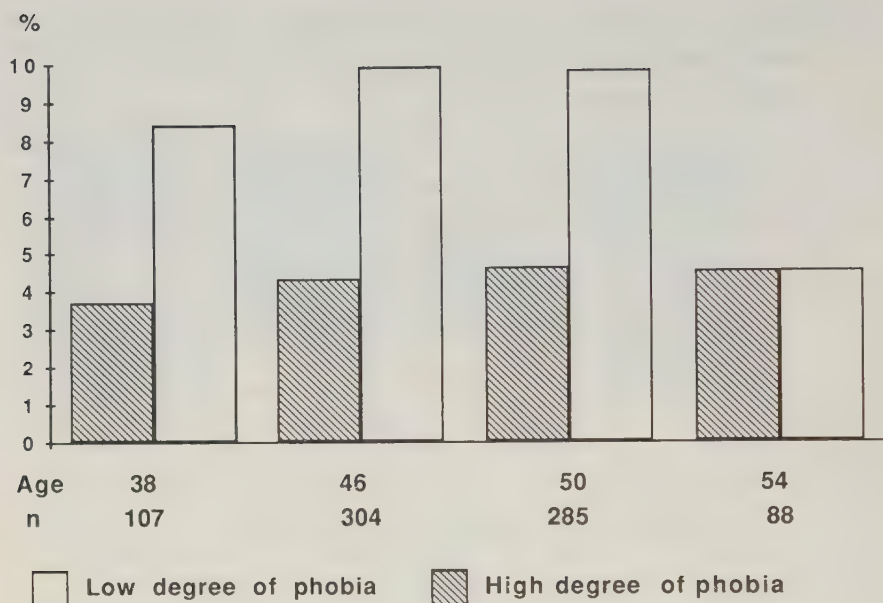


Fig. 11. Prevalence of dentistry phobia in relation to age.

The reported frequency of tooth brushing was not related to degree of dental treatment phobia.

Eighty-seven per cent of the phobic women stated that they had suffered from the phobia since childhood or adolescence. Six per cent developed their phobia after the age of 20 but more than 10 years ago. Only 7% had had the dental treatment phobia for 10 years or less. There was no differences between low and high grade phobias regarding duration or course of the phobia. All phobics reported a chronic course of the disease in 90% with partial remission at times. In 4% there was a constancy during the years. Six percent had experienced a gradual lowering of the degree of phobia with the years. Only 11% reported that they had been exposed to anxiety provoking dental treatment situations at onset of phobia. Of the women with dentistry phobia of low degree 6% were aware of this. The corresponding value on high degree phobics was 21%.

GENERAL DISCUSSION

In 1968 a medical investigation was contemplated at the Dept. of Internal Medicine of the Sahlgren's Hospital in Gothenburg. The opportunity was grasped by the head at that time of the Oral Surgery Dept., School of Dentistry, Malmö, who contacted the staff of the Gothenburg project and got permission to add a dental investigation and who subsequently organized that sub-project.

The methods and results presented in this thesis are to be looked upon from the viewpoint of the terms on which the investigation was started. The financial resources and staff - supplied from the Malmö Dental School - were rather limited. To carry through the collection of a substantial data material at another place presupposed the use of simple methods. Consequently the dental and periodontal description of each individual participant was reduced to a panoramic radiograph, a colour photograph and a questionnaire. These were collected by a dental nurse who had acquired a good technical and psychological skill by training at the Malmö School. In this way the staff could be reduced to one single person. A Paatero Orthopantomograph as well as photographic equipment was supplied by the Malmö study group. The orthopantomograms and negatives were sent to Malmö for development and further handling. The dental data collected in this way were later on evaluated and re-evaluated in Malmö.

In 1980, when a medical follow-up investigation was started, an Odontological Faculty and a Dental School had been established at the University of Gothenburg. Its Dept. of Oral Radiology was asked by the Malmö study group to take over the further dental examination. In spite of new and varied resources in equipment and staff, the originally adopted examination methods were continuously used in order to safeguard the comparability with the original investigation. The roentgen films were subsequently evaluated in Malmö.

The assessment of roentgenographically seizable conditions within the dental system would in some respects have been more precise if full mouth intraoral roentgenography could have been used. However, from radiation- hygienic and economic points of view orthopantomography is to be preferred. How much information is lost by the latter method?

In Paper I proof is given of a generally good agreement between the two methods with respect to the variables usually evaluated in epidemiologic studies. These include above all: number of teeth, teeth with and without fillings and similar gross characteristics. Also the assessment of marginal periodontal bone loss showed an overall good agreement. Although the distribution of non-measurable surfaces was dissimilar this did not influence the distribution of different bone score values or the mean bone heights obtained with the two methods. This may be explained by the high measurability of mandibular molars and premolars, which in this respect have been shown to be representative of the whole dentition (Björn et al. 1975). The agreement between the two techniques was less good for caries diagnosis where practically no lesions confined to the enamel were found in the panoramic radiographs. Even when lesions in the dentine were considered the agreement was poor which corroborates the results of Hurlburt & Wuehrman 1976, Balis 1981. In all, orthopantomographs showed to be satisfactory for the variables studied in Papers II-VII.

The sample presented in Papers II-VII was representative of an urban middle-aged population and is of special interest due to

- ◇ its large size and the fact that a number of other variables are described at the same time: socio-economic factors, somatic and psychic disorders.
- ◇ the choice of age strata instead of age groups with an interval of ages is advantageous. In this way the influence of age can be more appropriately studied, as the women within each age stratum were of almost dentical age.

There were obvious differences between the different age strata on number of remaining teeth. The differences, however, were not always the same between different ages. Very small differences were found between women aged 50 and women aged 54. It is probable that social reforms and better possibilities to visit the dentist step by step have improved the situation, and that the large differences between the various age strata studied thus only partly can be referred to age differences.

In Paper II it was shown that 14% of the women had no remaining teeth. In corresponding ages the figures were in agreement with Håkansson (1978) and (Lavstedt 1982). The figures were lower than those found in one rural district in Sweden (Sjöberg & Ståhle 1972) but higher than was found in an urban one (Axelson et al 1975).

The number of crowns per remaining teeth was higher in women aged 38 (11%) than in women aged 60 (31%). The percentages were lower than those found by Håkansson (1978).

Due to very low validity at examining caries lesions and radiolucent fillings the presented results of the variables intact teeth and teeth with fillings (Ahlqwist et al [Paper I]) should be taken with great care.

Loss of teeth was found in Paper III to be inversely related to level of education which is in agreement with (Kelly et al 1967, Smedby 1972, Anderson et al 1974, Håkansson 1978, Österberg 1981 and others) and the socio-economic group. No association was found between socio-economic status and mean periodontal bone heights which is in agreement with Lysell 1977, Norheim 1979a, Markkanen et al 1981. Furthermore no association was found between mean bone height and level of education which is in agreement with Dunbar et al 1968 and Markkanen et al 1980 and opposite to Russel & Ayers 1960, Anderson et al 1974 and Håkansson who found higher periodontal bone levels with higher levels of education.

The periodontal status as well as the progression of bone loss was studied in Paper IV by means of orthopantomographs, a technique which was found to be well fitted for the purpose since it was comfortable for the participants and thereby minimized the non-participation rate and at the same time gave good possibilities to evaluate the dental and periodontal conditions (Björn & Holmberg 1966 and Ahlqwist et al [PaperI]).

On an average two teeth were lost per woman during the 12 year period in age groups under 60. Based on the number of remaining teeth in 1968 the conclusion can be drawn that earlier loss of teeth per year had been considerably higher probably due to wider indications for extraction. Mean periodontal bone heights calculated on remaining teeth cannot be directly applied to the whole dentition. The progression rate calculated on the difference between consecutive mean values is further affected by extractions during the observed period. This effect will be more pronounced from 40 years and up since extracted teeth in these ages commonly have greater bone loss than the rest of the dentition (Björn 1974). Thus the progression of periodontitis most likely is to a certain extent underestimated in the present study. Another confounding factor is that indications for extractions are not the same in different socio- economic and different age groups. The present study confirms the data from Lavstedt et al

1982 in showing that marginal bone loss after a lapse of 12 and 10 years respectively is very limited for the great majority of individuals. To make a comparison possible a 0.1 bone score value in this study can be translated to approximately 2.5% of the total root length. This means that 82.7% of the participants had suffered a progression less than 7.5% of the root length compared to 81.4% in the study by Lavstedt et al.

The mean progression rate seems to be somewhat lower in the present study which may be due to differences in the method used for bone height measurements.

Furthermore the progression in this study is neither correlated to periodontal bone heights at the first examination nor to age in contrast to results reported by Lavstedt et al.

In 1980 the 38 as well as the 50 year old women had on an average more remaining teeth than corresponding age groups in 1968. Loss of molars has been the most important reason for the reduction of the dentition. Thus it is notable that in the present study the number of individuals having at least two molars left was 17-19% higher in 1980 cohorts than in those 12 years earlier. The result may reflect the changed attitude towards extractions as an alternative therapy even in molar regions. In 1980 in the 38 year cohort only 34.5% had an average reduction of marginal bone loss extending to 15% of the total root length compared to 52.5% in 1968. In the 50 year old women, however there was no significant difference between the two cohorts in this respect.

The importance of educational level and/or dental care attendance on periodontal status in a population of middle aged dentate women during a 12-year period is presented in Paper V. The division into levels of education is based on the existing school forms during the participating women's adolescence. The choice of school attendance is the result of several factors such as social relations and possibilities of education at the place of growing up. Furthermore at the time of World War II, the economic obstacles to continued education were insurmountable to the great majority of people in Sweden. Before the fifties it was not a matter of course even for intellectually gifted women to join higher education.

Information on "time elapsed since latest visit to a dentist" has been used in studies by Smedby 1972, Jensen 1974, Gjermo 1976 and Norheim 1979b and had proved to have a high validity. In the present investigation small percentual differences between levels of education in the different year groups were found except for the

38-year old women in 1980 who showed a clearly lower share in the lowest educational group compared to the figures in 1968. This reflects the relatively stable school system in Sweden which had been existing during decades before the recent school reforms. By increasing level of education a greater number of remaining teeth were found in the present study which is in agreement with Björn 1971, Anderson et al 1974 and Håkansson 1978.

Regarding the number of teeth lost during the 12 year period taking educational level in consideration the present study showed no correlation contrary to findings by Dunbar et al 1968. A significant difference was, however found between educational level 1 and 2/3. In the cross-sectional study a higher number of remaining teeth was found in the 38 year cohort varying from 1 tooth at educational level 1 to 2.4 teeth at educational level 3. In the 50 year cohort the corresponding percentages were 3.6 and 2.1 teeth at educational levels 1 and 3 respectively. No statistical differences were observed relating periodontal bone heights between the different educational groups which mainly can be explained by differences in number of remaining teeth between the educational groups. Loss of teeth, especially upper molars and premolars will increase the mean periodontal bone height for the dentition due to the fact that the mentioned teeth have a mean bone height which is lower than the mean for the whole dentition (Halling & Björn 1986 [VI]). Another explanation may be that the method used for bone height assessment was too blunt.

It was found that 68% of the participants had visited the dentist during the latest year (1967), a higher figure than was found in samples of men plus women by Smedby 1972, Johansson 1970 and Sundberg & Eriksen 1976 who found that 43-55% had visited the dentist. The higher figure in the present study can be explained partly by the fact that all participants in the present study lived in a big city who are known to visit the dentist more often than men (Håkansson 1978). Significant differences in number of remaining teeth were found between dental visit groups which is in agreement with Björn 1974.

The periodontal state does not always seem to be a crucial factor for tooth extractions. The interaction between dentist and patient may well result in therapy that could not be expected from the state of disease (Sheiham 1973).

The present study showed that there was a statistical difference in marginal bone height related to the frequency of dental visits. Björn 1974 found no difference between the sporadic and the regular group in her study of *males*.

As shown in Paper VI the mean percentage of measurable bone heights was somewhat lower than in other studies of the same type (Mutschelknauss & von der Ohe 1978; Adrianes et al 1982; Ahlqwist et al 1986). The reason may be the differences in roentgenological technique but also the fact that in the present study very stringent criteria were used for acceptance of a surface as measurable. Mandibular molars and premolar showed the highest measurability which is in agreement with what was found by (Björn & Holmberg 1966; Björn, Björn & Halling 1975; Adrianes et al 1982 and Ahlqwist et al 1986). Maxillary molar-premolar and incisor areas have a low measurability due to blurring, overlapping of adjacent structures (Ainamo & Tammisalo 1967; Gröndahl et al 1971; Adrianes et al 1982 among others).

The variation in periodontal breakdown is substantial between different regions of the dentition. The breakdown is considerable in all molar areas, and here loss of teeth usually is started. The periodontal bone heights within the molar areas, which in the present study originally participated with 37.5% in the mean bone height of the total dentition, will with increasing age have a gradually decreasing influence on the overall bone level of an individual.

Therefore, the possibilities of summarizing the periodontal bone height by a single index are rather restricted. Due to the strong variation in progression of bone destruction between different areas of the dentition, an index of bone loss inevitably will be influenced by the composition of the remaining dentition. Special care should be exercised when studying small samples.

Bone height indices - as well as other periodontal indices - differ from most other odontological indices principally by being based on direct measurements employing an interval scale. This means that it probably will be impossible to design an index comprising also maximal damage, i.e. total loss of supporting bone. Therefore, the task of developing by bone height measurements an index representing a true overall mean of bone loss seems to be impossible.

In epidemiological investigations it is of course rather important that diseases to be studied are described by means of standards that imply the same meaning regardless of the specific composition of the dentition of the separate individual. One way of tackling the problem is to confine comparisons to defined and limited sections of the dentition. This idea is substantiated by several studies (Ramfjord 1959; Björn 1974; Björn, Björn & Halling 1975; Bolin 1986 and others).

The selection of suitable teeth or groups of teeth has usually been based on the degree of correlation between the mean bone height for these on one hand and that for the total remaining dentition on the other. The correlation coefficients observed in the present study varied between .64 and .78. However, bone heights valid for the teeth or groups of teeth with the highest correlation did not always render the best measure to represent the total remaining dentition, an observation, which of course is important above all for descriptive studies. Consequently there was no clear indication to select teeth with the strongest correlation to the rest of the dentition. It appeared in the subsample which had remaining teeth of all types (the 603 sample) that the mean bone height for the mandibular molar areas gave the best agreement with the values for the total dentitions.

In the subsample with reduced representation of types of teeth a combination of measurements at mandibular incisors and canines resulted in means that best agreed with those for the total dentition.

From radiation-hygienic points of view availability of an abbreviated index is essential for the possibility to utilize measurements based on roentgenographs in order to compare the degree of bone destruction in different populations.

The term "dental phobia" was in Paper VII defined as a monosymptomatic or simple phobia characterized by a persistent, irrational fear resulting in a compelling desire to avoid dental treatment. The prevalence rate of 13,4% of the women with dentistry phobia seems to be consistent with earlier results (SIFO 1962, Håkansson 1978, Scott & Hirschman 1982). However only 4.3% of the women presented a phobia of high grade. Awareness of a frightening experience of dentistry did not appear to be an important factor in the development of dentistry phobia, which is in accordance with Lautch 1971 but contrary to what was found by Ingersoll 1982, Shaw 1975. In this study almost 90% developed their dentistry phobia in childhood or adolescence which is in accordance with Lautch 1971. No relationship was found between prevalence of dentistry phobia and age, which was also reported by Wardle 1982. Those women with dentistry phobia, especially the high grade phobics, had more often passed lower school education and belonged to lower social classes than the rest of the sample. This might be attributed to harm-avoidance and negative parental attitudes towards dentistry among those with lower education (Shoben & Borland 1954, Franco 1978). Women with dentistry phobia visited the dentist less often with similar patterns as observed in low income patients (Smedby 1972). As expected, the

higher the dentistry phobia score the higher the number of missing teeth. Probably due to excessive tooth loss in the severe dentistry phobia group the periodontal bone level was even higher here than in subjects with low grade phobia . To compensate for tooth loss, an abbreviated mean periodontal bone score was calculated for the surfaces which had the highest degree of measurability and had remained for the longest period in the dentition. However the results from the two techniques used were mainly the same.

CONCLUSIONS

The results from the present study on a representative sample of a female population (initially 38, 46, 50, 54 and 60 years of age) in Gothenburg examined in 1968-1980, show among other things, that

- ◇ The share of edentulous women was 4 per cent in women aged 38 compared to 40 per cent in women aged 60.
- ◇ There was an over-representation of edentulous women among those who had grown up in a rural area, who had low education, and those who belonged to a low socio-economic group.
- ◇ The average number of lost teeth during the 12 year observation period varied from 1.7 to 3.3 in the different age strata and the alveolar bone height had been reduced in all age groups.
- ◇ Improvement of dental status was found for 38 and 50 year old women both in relation to number of remaining teeth and periodontal state when comparing the situation 1968 and 1980.
- ◇ There was no difference between educational groups in the number of teeth lost during the observation period.
- ◇ For the 38 and 50 year cohorts there were significantly more remaining teeth and more periodontal bone support for women in all levels of education in 1980 compared to 1968.
- ◇ Significant differences in relation to remaining teeth and periodontal bone heights were found between visit group 1 and 2/3.
- ◇ Mean periodontal bone heights were similar in women aged 46,50 and 54 while they were somewhat lower in women aged 38 and a little higher in women aged 60.

- ◇ About 83% of the women had a mean bone height of the same magnitude at both examinations, while about 5 % showed a considerable progression of bone loss. The progression of bone loss during the observation period did not seem to be related to the initial periodontal status.
- ◇ No difference was found between levels of education at comparison of the mean periodontal bone heights in 1968 and 1980.
- ◇ Pronounced progression of marginal bone loss corresponding to 1/4 of the root length had occurred in 6.8, 7.5 and 4.8% of the women in educational group 1-3 respectively.
- ◇ Mean periodontal bone height for mandibular molars showed the best congruency to mean with the whole dentition in the three samples studied.
- ◇ Since the number of individuals having mandibular molars is strongly reduced the combination of lower incisors+canines may be the region of choice to present the periodontal bone height for the whole dentition.
- ◇ The point prevalence of dentistry phobia was 13.4%; 4.3% suffered a dentistry phobia of high degree.
- ◇ Orthopantomographs were found to be useful tool in epidemiological studies, except for evaluating carious lesions and radiolucent fillings.
- ◇ Phobia of dental treatment was related to high number of missing teeth, high amount of alveolar bone loss and a high prevalence of removable dentures.

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